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Beyond Borders, Beyond Conflict: Managing the Kabul-Indus for a Shared Future

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ABSTRACT

For nearly three decades, the Kabul-Indus shared river basin has been a source of tension between Pakistan and Afghanistan. Straddling the border, the basin's water sustains about 34 million people in urban and semi-urban areas. However, perceived inequalities in water allocation and the impacts of natural disasters have hampered cooperation in managing these vital resources. This pioneering study delves into the complexities of the Kabul Indus River basin, exploring potential opportunities for cooperation and threats of conflict by using the TWIN methodological framework. This study investigates the complexities surrounding the Kabul-Indus basin, employing a transboundary water interaction nexus framework, by analyzing documented reports of the events, official documents, media reports, newspaper articles, and student theses from 2000 to 2024. Recent trends in the Kabul Indus River Basin suggest increased potential for cooperation, particularly in areas of shared interest. By adapting UNECE 1992, 1997 International Water Conventions setting guidelines and principles, a potential path forward can be established for cooperative water management framework between the two countries. These conventions allow for multilateral, non-binding cooperation, even in the absence of a formal agreement. This study concludes that by exploring shared interests and leveraging these conventions, Pakistan and Afghanistan can move towards a more collaborative future in managing the Kabul-Indus River Basin. This collaboration is essential for ensuring the water security of both the nations.

Keywords: Transboundary water; Kabul-Indus River basin; Cooperation; Conflict; Agreement; Water convention

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1. INTRODUCTION

Across the globe more than 260 transboundary river basins cover 45 per cent of landmass and account for 60 per cent of global river flow. The borders that share the transboundary water flow are often prone to inter-state tensions if inequalities are perceived in water allocation and at of natural calamity incidence[1]. When a legal agreement does not exist, then the United Nations plays a vital role in managing shared water resources through the two key conventions: the 1992 UNECE water convention and the 1997 convention[2] on the law of non-navigational uses of international watercourses[3].

Water resource and conflict resolution has gained significant attention in last three decades in South Asia, due to population pressure, and climatic stress (Anjum et al., 2019; Williams, 2019; Goes et al., 2016; Shroder and Ahmadzai, 2016).

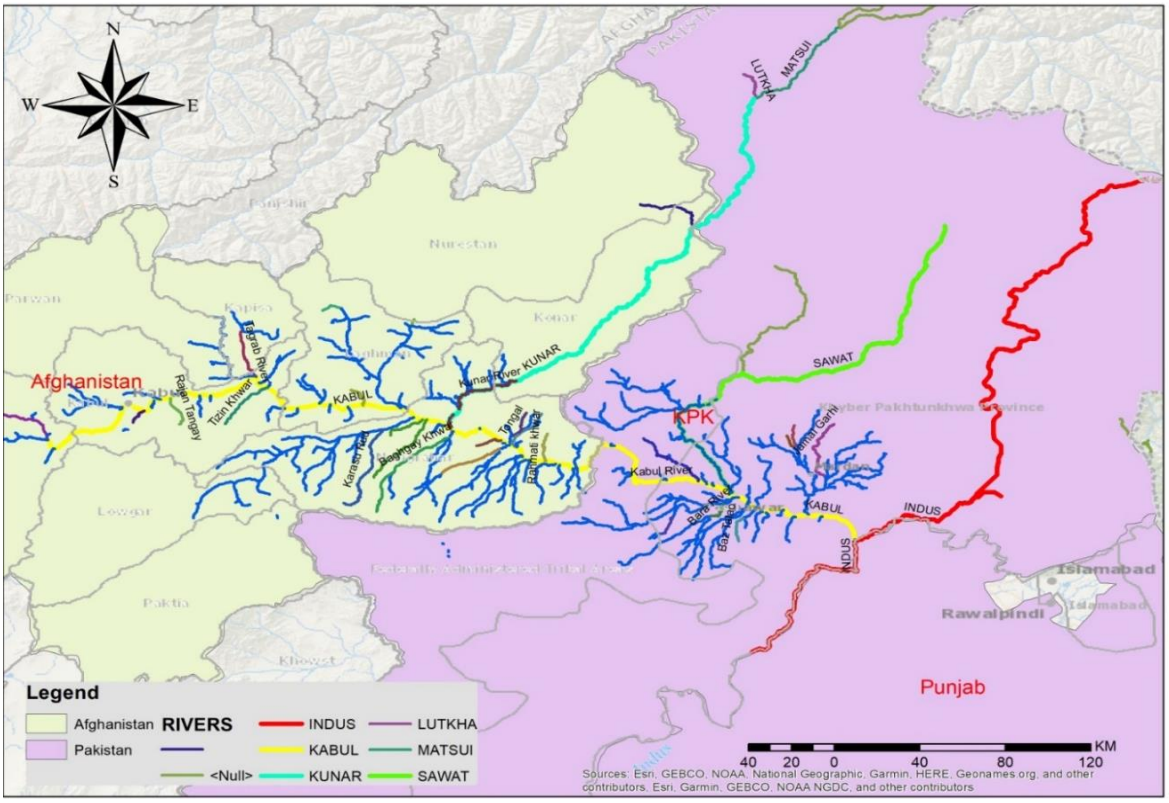

Figure 1: Environmental and Geographic Characteristics of the Kabul-Indus River Basisn. The Arc-GIS software is used to generate the provided map. It depicts Kabul river flows for 560 km inside Afghanistan, then Kunar River, a main tributary of Kabul River, originating in the Chitral region of Pakistan, which flows into eastern part of Afghanistan downward from Pakistan (Yıldız, 2015; King and Sturtewagen, 2010). Subsequently, it re-enters Pakistan, where it receives water from the Swat River and eventually

[1] The water conventions have a broader scope, encompassing all non-navigational uses of international watercourses. Including surface and groundwater (excluding confined aquifers). Its global applications and emphasis on general principles like equitable and reasonable utilization preventing harm, and cooperation between watercourses-sharing states. The water convention initially regional, was amended in 2023 for global participation. Now, it takes a more action-oriented approach focusing concrete measures such as establishing joint institutions and settings water quality objectives. Notably, it emphasizes joint institutions and agreements for specific watercourses or lakes, alongside regular water quality and quantity monitoring. While both conventions can apply simultaneously, the water conventions have a broader scope and stronger obligations with the watercourse's convention providing general guidelines. As of February 2024, the water convention has 44 parties, while watercourses convention has 34. Despite their differences, both conventions remain crucial for fostering cooperation and sustainable management of shared water resources.

[2] This convention focuses on the protection and sustainable use of transboundary waters, including lakes and rivers shared by multiple countries: https://unece.org/DAM/env/water/publications/WAT_Text/ECE_MP.WAT_41.pdf: UNECE (United Nations Economic Commission for Europe) (2020). Frequently Asked Questions on the 1992 Water Convention. Retrieved from: https://unece.org/environment-policy/publications/frequently-asked-questions-1992-water-convention

[3] https://legal.un.org/ilc/texts/instruments/english/conventions/8_3_1997.pdf.

merges with the Indus River basin. Overall, the total length of KRB basin is 700 km (Rasooli and Kang, 2015).

Historically, the relationship between Afghanistan and Pakistan is strained, and the Kabul River Basin (KRB) has often been a source of tension. Pakistan shares 9 rivers with Afghanistan, 3 of which flow into the Indus River, while 6 rivers flow towards Balochistan. Millions of people live around these 9 shared rivers. The KRB supplies over 20 billion cubic meters of water annually to approximately 24 million inhabitants across a 92 square kilometer area (Masood et al., 2018). The basin's substantial elevation differential offers considerable hydropower potential, capable of driving regional economic development, particularly in Afghanistan. While the current combined hydropower capacity in Pakistan and Afghanistan stands at 465 MW (Khan and Nafees, 2018). The basin's untapped hydroelectric potential is substantial. Home to major Afghan cities, including the capital Kabul, the basin is densely populated, spanning 15 Afghan provinces and 106 districts directly and indirectly, and one Pakistani province with 7 districts directly. Given the interconnected nature of water use within the basin — including agriculture, hydropower, and urban consumption — unilateral management by either Afghanistan or Pakistan is suboptimal.

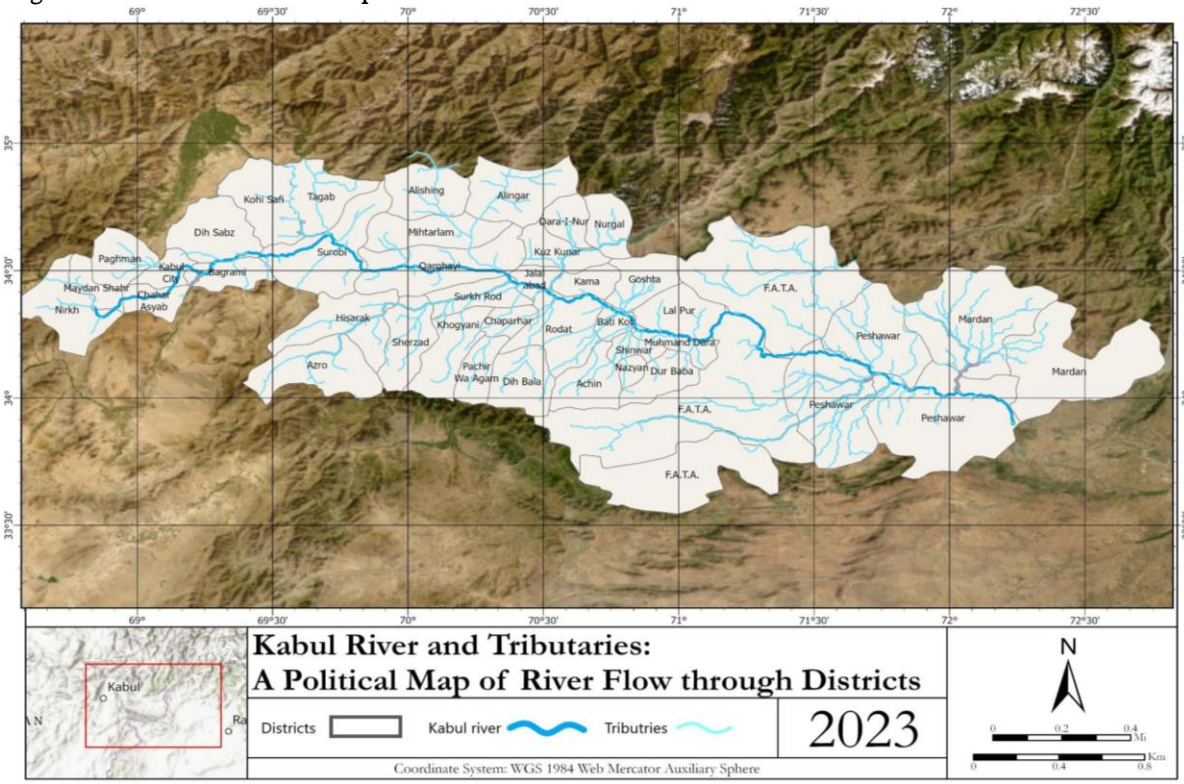

Figure 2: The map illustrates the Kabul River's flow and its tributaries through various districts. Key features include the Kabul River basin (KRB), its small tributaries, district boundaries and geographic coordinates for precise referencing, including those in the former federally administrated tribal areas (FATA)[4]. Now merged with Khyber Pakhtunkhwa, this region is prominently featured in the map aims to showcasing the rivers influencing the area. This visualization aids in understanding water resource management, irrigation planning.

Primarily, the Kabul River basin originates in the western mountains of Koh-i-Baa and Baghlan, the northern Salang and Bamyan valleys, the northeastern Kunar valleys and the southern Koh- i-Safi region. Several major rivers, including the Bamyan, Salang, Shankardara, Kabul Logar, Tagab, and Baghlan, flow through this basin, which the map above depicts that. All of the aforementioned rivers contribute to the flow of the Kunar River that primarily feeds into the Indus River near Jalalabad before entering Pakistan. Additionally, smaller rivers such as Kurram and Shumal join the Indus from the

[4] FATA was merged with Khyber Pakhtunkhwa in May 2018.

south. Overall, Kabul River basin and its tributaries covers 11% area of Afghanistan; however, its population density is more than 95%.[5]

Table 1: Key Characteristics of Kabul-Indus River Basin (KRB)

Parameter	*Value*
Kabul River's Share in Indus River System	
Total Western Flows Including Eastern Flows	15.75% 15.05%
Kabul River's Contribution into Indus River System at Dakah	11.30%
Chitral River's Contribution to Kabul River (Kunar River)	51%
Afghanistan's Contribution to Kabul River	49%
Annual Average Flow of Kabul River at Nowshera (1976-2019)	21.25 MAF)[6]
	26.21 (BCM)[7]
Kabul River flow entering Pakistan at Dakah	19.206 (BCM)
Average total water available in western rivers (including Kabul)	170 BCM
	137.821(MAF)
Kabul River's contribution from Afghanistan	19.35 BCM
	(15.571 MAF)

Sources: Iqbal, M. (2020)

Table 2: Pak-Afghan Kabul-Indus River Basin Characteristics

Variable	*Afghanistan*	*Pakistan*
Area Km (Country's Share)	72000 (58%)	52000 (42%)
Population Density (Per Sq Km)	100	276
Average Precipitation (MM)	992 (upper basin) 182 (lower basin)	459 (upper basin), 109 (lower basin)
Irrigable Area in the Basin Per Hectare	484100	14870000
Total Surface Water Available	21650	181620
Total Groundwater Available	1920	55000
Total Water Available	23570	235620
Storage Capacity (MCM) (Effective In 2013)	564.5	18177
Proportion of Surface Water Use in Basin	24%	68%
Proportion of Surface Water Use in Basin as Compared to Groundwater Available	28%	112%
Proportion of Total Water Use in Basin as Compared to Available Total Water Available	25%	77%

Data source: Afghanistan research and evaluation unit; Thomas et al. (2016)[8].

The above tables 1 and 2 depict that Pakistan claim more rights over the KRB basin, being both an upper and lower riparian state. Additionally, Pakistan's unique geographical and topographical conditions strengthen its claim. Over the past two decades, climate change and more than 4 decades of continuous war in Afghanistan have intensified water resource management challenges in the basin (Andik and Mianabadi, 2023). However, due to the lack of scientific knowledge and the absence of a formal agreement on water rights for over four decades have exacerbated the situation between both the countries.

5 NSIA, https://nsia.gov.af/.

6 Million Acer Feet (MAF): An imperial unit that measures the volume of water needed to cover one acre of land to a depth of one foot.

1 MAF is equivalent to approximately 1,233,489 cubic meters. Conversion between BCM and MAF, the following approximate conversion factor can be used: 1 BCM ≈ 0.8107 MAF.

7 Billion Cubic Meter

8 Since most of the variable's updated data is not available, therefore, the author has used the data table of the reference study.

Indeed, water is an economic good, a tradeable commodity, and essential for well-being. However, climate change in South Asia has recently exacerbated socio-political and geo-climatic factors, fueling the economic distrust. This has become a significant obstacle to bilateral collaboration on KRB water resources. Particularly in the Hindu Kush Himalaya (HKH) region, climate change is a leading cause of changes in rainfall patterns, temperature, and land use activities. These changes are ultimately accelerating the decline in the quantity and quality of freshwater and groundwater level. The situation is particularly concerning for the snow-fed Kabul River basin, because even a small increase in temperature leads to increased runoff water in summer and reduced water available in winter (Tiwari, et al., 2021; Edum, 2023; Mirumachi, 2015). With over 24 million people relying on the Kabul River basin and its tributaries, the absence of any transboundary bilateral agreements between Pakistan and Afghanistan is a significant international issue at the South Asia level. Transboundary water agreements offer a valuable framework for integrating water dialogue and negotiation. This is especially important given the complex challenges and political realities surrounding water resource management in the region. Pakistan's decade-long pursuit of a bilateral agreement with Afghanistan on the Kabul River highlights the need for such a framework (Smolenaars et al., 2022; Vick, 2014). For this reason, collaborative efforts are imperative to prevent actions in one country from adversely affecting the other, additionally, for efficient water resource management and maximizing mutual benefits (Huseynov and Salik, 2018; Najmuddin et al., 2017; Mohmand, 2011). In short, a legally binding agreement between Pakistan and Afghanistan seems unlikely in the near future. However, international water conventions, such as the 1997 Watercourses Convention and the 1992 UNECE Water Convention, offer valuable guidance for sustainable water resource management (Hayat, 2020).

Therefore, even Pakistan and Afghanistan did not ratify the conventions, but the conventions can still provide valuable guidance for bilateral cooperation. Article 9 of the Watercourses Convention allows for agreements to prevent water conflicts, while Articles 3 and 8 outline how neighboring states can establish joint mechanisms (Estrela, 2024; UNECE, 2020). Similarly, the 2004 Berlin Rules aim to integrate ecological considerations, promote sustainability, and encourage public participation in water management (Tanzi, 2014). Notably, to date, no study has comprehensively analyzed all the respective challenges and opportunities for cooperation within the Kabul and Indus River basin context (Latif et al., 2021; Nori, 2020; Thomas et al., 2016; Shobair and Alim, 2004).

This is the first study with respect to Kabul-Indus River basin that explores the potential opportunities for cooperation and threats for conflict by using the TWIN methodological framework. The research aims to investigate the current state of transboundary water cooperation between Pakistan and Afghanistan and assess the need for a Kabul-Indus River agreement. To achieve this, a systematic approach combining qualitative and quantitative method is required for trend analysis to find the true documented intensity of the urge to collaborate and cooperate with each other at policy level through any possible bilateral agreement. The urgency for such an agreement stems from multiple converging factors, including population growth, climate change, regional political instability, and natural resources depletion. For this reason, the prime objective of this study is to suggest a sustainable and equitable water management framework for the Kabul River basin, to achieve the broader objective of shared water resource management. Without collaborative management framework, population growth, water scarcity, and political tensions will further strain the resources, potentially escalating existing conflicts and creating new destabilizing pressures in the region. In epitome, this study combines its analysis with an examination of the trust deficit between the two states, highlighting the need for collaborative management strategies for regional stability due to the lack of documented conflicts and cooperative events over the years.

2. LITERATURE REVIEW

Water, a vital resource, is not a perfect market commodity due to its shared nature and potential for overexploitation. Market failures often lead to inefficient allocation and environmental degradation (Canfield, 1973). This especially problematic in transboundary water management; instead of relying solely on perfect competition, sustainable water management is crucial. This involves recognizing water's true value, adapting practices, water allocation policies, and implementing environmentally friendly technologies. As Allen et al. (1989) suggest, countries facing water constraints should adopt a sustainability approach. The Nile River example (Allan and Howell, 1994) illustrates this, highlighting

the need to shift from agriculture-centric water management. Effective management requires considering geographical, socio-economic, and political factors beyond economic efficiency, especially in transboundary contexts involving allocation, infrastructure, and potential conflicts.

Zeitoun et al. (2011) present a groundbreaking analysis of transboundary water cooperation and conflict, challenging traditional perspectives and introducing a novel theoretical framework. This research, centered on the Jorden River basin and its geopolitical complexities, has significantly contributed to the field of water governance. A key contribution is the incorporation of soft power into the analysis of water negotiations. By examining the case of Palestine, Israel and Syria, the study demonstrates how powerful states can leverage soft power to shape agreements to their advantage, even when framed as cooperative. Zeitoun et al. (2014) further deepen their analysis by integrating historical thought on social justice with the study of transboundary water interaction using the "nexus approach". The results of the TWINS model reveal the importance of fairness, equitable processes, and underlying structures in achieving just and sustainable water management. They emphasize that assuming complete equality between parties is often flawed, and privileging specific concepts of justice is crucial for fostering cooperation. Most recently, Zeitoun et al. (2017) made significant contributions by framing a theoretical framework and conducting an empirical analysis of international water conflicts. The study aims to equip the negotiation tools with better understanding to find the shared pathways of cooperation. The historical meta-analysis reveals that existing water agreements are rarely black and white, often involving a mix of cooperation and conflict. It critically acknowledges that some conflicts can be productive, pushing for better water management, while some forms of cooperation can be harmful by locking weaker countries into unequal arrangement.

The dynamics of the transboundary water interaction framework are built by combining two areas of study: 1) research and compliance contestation, challenging powerful nations (counter hegemony) and dominance in water management (counter-hydro-hegemony), and 2) theories about how social systems change. The framework's usefulness is demonstrated by applying it to real-world water agreements from 1990 to 2015 on the Jordan, Tigris, Euphrates, Mekong, Ganges, Amu Darya, and Nile River. These case studies highlight the role of power imbalances in maintaining the status quo or driving change in water agreements. The study concludes with insights into how power imbalances affect the transboundary natural resource distribution hegemony. Similarly, Salmoral et al. (2019) explain that water diplomacy and management are interconnected and go hand-in-hand because water diplomacy encompasses a wider scope of work. Therefore, it has potential tools for resolving conflicts over shared water resources across borders (transboundary). The study analyzes two approaches to determine which is more appropriate and effective when combined governance with the tradeoff between different resources, bringing the stakeholders to the table and creating balanced agreements. This is illustrated through case studies of a wastewater treatment plant in Jordan and a research project on the Zambezi River basin. Their objective was to understand how water diplomacy benefits complex interaction to navigate the political realities of resource sharing by employing joint fact-finding and collaborative management, to promote mutually beneficial solutions and common understanding. Additionally, Grünwald et al. (2020) examine a complex web of cooperation and conflict by analyzing the Mekong River, a lifeline for over 65 million people across six nations. The study results offer potential benefits for both upstream and downstream countries by examining the existing challenges of the Xayaburi Dam in Laos, focusing on interactions with Thailand, Cambodia and Vietnam over the past two decades. The case study results reveal a significant gap between public and government perspective highlighting the need for improved communication and stakeholder involvement in managing these shared resources. Similarly, Chenoweth and Al-Masri (2021) examine how political leadership decisions affect sectoral growth by examining the dynamics of Jordan River. The study finds that effective policy direction is the primary reason for growing cooperation and coordination between the water and energy sectors in Jordon.

While numerous studies about the Kabul-Indus River exist, Atef et al. (2019) analyze the different stages of water conflicts between Pakistan and Afghanistan. For the first time, the study examines historical disputes often resembling zero-sum games (the game theory), where one party's gain comes at the cost of the other's loss. It introduces the decision support systematic tool (DST) as a mechanism designed to transform conflict into cooperation. The Kabul River basin presents unique circumstances that render discussions based solely on upstream and downstream water rights unproductive under the principles of absolute territorial integrity and sovereignty. This is crucial because water resources management inherently faces challenges in balancing competing interests and fostering collaboration,

especially given that water flows disregard political borders and necessitate complex geopolitical negotiations.

Given the evolving situation of hydro diplomacy in South Asia, Ali Shah and Nabeel (2023) explained effective management of shared water resources, particularly for the Kabul, Kurram, and Gomal rivers, requires an understanding of the internal water governance structures of Afghanistan and Pakistan. By utilizing mixed-method approach, they have analyzed the legal and institutional frameworks in both countries. Through document reviews and expert interviews, the study examines national water laws and institutions in Afghanistan alongside federal, provincial, and local water governance in Pakistan. Despite, well-crafted legal frameworks in both countries, implementation remains a significant challenge on both sides of the Durand line. The research concludes that strengthening internal water institutions and fostering multilevel stakeholder engagement are crucial for successful transboundary water management. By improving internal water governance and facilitation coordination on water policies, Afghanistan and Pakistan can pave the way for a more sustainable future for these shared basins. Salman et al. (2018) argue that despite the benefits of cooperation, Pakistan and Afghanistan lack a comprehensive mechanism to manage their shared water resources. Meta-analysis of the existing policies and situation across the borders of the two countries disclosed the absence of a clear understanding of the benefits of cooperation. Despite the existence of international conventions on water, such as the 1992 UNECE Convention and the 1997 UN Convention on the Non-Navigational Uses of Watercourses, which provide framework of transboundary water cooperation even if a treaty does not exist. Similarly, Dhaubanjar et al. (2024) drew a cost curve for hydropower revealing that the Swat and Kabul sub-basin possess a significant portion of cost-effective and sustainable untapped potential beyond what is visually perceived. However, water allocation to other sectors acts as a significant constraint, diminishing a third of the technical potential when considering sustainability. Ultimately, human decisions, encompassing factors like scale, configuration, and sustainability considerations, wield a more substantial influence on hydropower potential than assumptions made in model parameters. By quantifying hydropower potential across various policy scenarios, we underscore the importance of defining hydropower sustainability from a basin-scale perspective. This approach aligns with the principles of energy justice and ensures a balanced fulfilment of sustainable development goals related to water and energy throughout the Indus region. Overall, the use of soft power, decision support tools system, the transboundary water interaction nexus (TWINs), mixed-method approaches, and meta-analysis are effective hydro-diplomatic strategies for addressing water management challenges (Warner, et al., 2017; Akhtar and Shah, 2020; Güven and Bibi, 2020). Transboundary research always offers a rich tapestry of knowledge on transboundary water management particularly as these water resources are often subject to complex technical challenges, the interplay of leadership and diplomacy, and the continuous influence of power dynamics.

Additionally, a review of the literature reveals that the UNECE 1992 Water Convention and the UNECE 1997 Watercourse Convention have become integral to global transboundary water agreements, as these conventions provide the foundation for cross-border water cooperation and collaborative mechanism. Particularly, an extensive literature review (Omer et al., 2023; Buisson et al., 2023; Gul et al., 2022; Matheswaran and T Akhtar, 2023; Ali and Akram, 2019; Habib, 2014; Renner, 2013; Thiessen et al., 1998; Thiessen and Loucks, 1992) reveals that previous studies on the Kabul-Indus River Basin have often overlooked specific opportunities for transboundary water agreements within the unique geopolitical and socio-economic context of the region. This gap highlights that hydro-diplomacy in South Asia remains an evolving field, with limited models and techniques available for comprehensive analysis. Given the power imbalances and climate vulnerabilities affecting the Kabul River Basin, there is an urgent need for a deeper understanding of hydro-political opportunities and risks to support equitable water management for millions.

3. METHODOLOGY

This research has employed a mixed-methods approach, combining qualitative and quantitative analysis to examine the transboundary water interaction nexus between Pakistan and Afghanistan in the Kabul-Indus River Basin.

3.1. Conceptual Framework

The study draws on the Transboundary Water Interaction Nexus (TWINs) framework, originally developed by Zeitoun and Mirumachi (2008) and further refined by Grünwald et al. (2020) to analyze the complex interplay of political, social and environmental factors that shape transboundary water relations. With a specific focus on the shared objective of transboundary water cooperation outlined in the UNECE 1992 Watercourses Convention and 1997 Non-Navigational Use Convention, this research aims to investigate to the potential for cooperation and conflict in the Kabul -Indus River Basin. This framework allows for a nuanced understanding of the dynamic between conflict and cooperation, and the role of various actors in shaping water governance. Particularly while soft strategies options are being tested and objective is to evaluating these strategies and their current status.

3.2. TWINS Empirical Analysis

Framework-six-levels (cooperation): For this study, a qualitative and quantitative empirical method was used. For qualitative method, comprehensive literature is reviewed by using the google search engine, google scholar, government repositories, gray literature, HEC PhD thesis, INGOs, international financial institution (the World Bank, IWMI, CABI) reports, treaties, and legal framework of UNECE 1992, 1997. The google search has shown 10700 results in 0.34 seconds when the Kabul Indus River basin term was inserted. For relevant content analysis and to develop for horizontal row and vertical column for TWINs metrics, qualitative coding content was used. For to make analysis rigorous quantitative matrix ratio analysis approach for TWINs coded variables is used to determine that what is the current level of cooperation and conflict.

This study has employed reevaluated technique used by Grünwald et al. (2020) for TWINs analysis. For this, the six opportunities for cooperation have been searched from various sources and the results of the studies are carefully analyzed in line with the following key variables on horizontal axis of TWINs matrix: Silent, Exploratory, Strategic, Accountable, Affinitive, and Intuitive on horizontal axis. On vertical axis: Non-politicized Conflict, Depoliticized Conflicts, Re-politicized Conflict, Politicized Conflict, Scrutinized Conflict, and Violent Conflict. Since these variables were adapted for the Xayaburi Dam case study through a mixed-methods approach, combining published articles and repository data. The Xayaburi Dam case study exhibits unique characteristics of conflict and cooperation, similar to the work of Zeitoun et al., (2011).

These coded words were adapted for the Xayaburi Dam case study (Grünwald et al., 2020) through mixed method approach combining published content and occurrence of events documented evidences. The Xayaburi dam research study has more proximity with Kabul Indus River basin (KRB), and exhibits similar characteristics of cooperation and conflicts as like KRB basin. However, the Pakistan-Afghanistan case study is quite different from Zeitoun and Mirumachi's (2008, 2014) and Zeitoun, et al., (2017) research on war-torn Middle Eastern regions. KRB analysis involves a more complex geopolitical context, akin to the Xayaburi Dam conflict between upstream (Laos, Thailand) and downstream (Cambodia, Vietnam) countries.

3.2.1. Horizontal Axis

1. Silent cooperation (+1) = low level of cooperation with limited joint actions and vague acknowledgement of water issue in relevant literature and in events and action at first level of diplomacy.
2. Exploratory cooperation (+2) strategic actors' realization on some joint actions due to necessity but lack shared goals and knowledge documented evidences.
3. Strategic cooperation (+3) = literature shown that shared goals exist, but disagreement remains on how to achieve them.
4. Accountable cooperation (+4) = agreement on procedure with a focus on non-binding cooperation for flexibility; ministerial meeting becomes frequent.
5. Affinitive cooperation (+5) = state policies are synchronized with legally bindings agreements increased data sharing and good will gesture.
6. Intuitive cooperation (+6) = full entanglement of political agendas beyond the river: binding agreements adapted at international and domestic level.

3.2.2. Vertical Axis (conflict)

1. Non-politicized conflict (-1) = less documented events and very low level of conflict with minimal impact on transboundary water governance.
2. De-politicize conflicts (-2) = when few studies cover strategic actors downplay political aspects of water issues; conflict resolution is technical and avoids public discussion at policy and implementation level.
3. Re-politicized conflict (-3) = high number of papers are published about recurring disputes and fueled by public and political scrutiny; civil protest demanding change become more frequent and documented.
4. Politicized conflict (-4) = water issues are used in broader political agendas; media coverage increases with public outcries and official attacks.
5. Scrutinized conflict (-5) = water seen as existential threat. Emergency measures taken, and civil unrest may erupt; International arbitration possible.
6. Violent conflict (-6) = highest level of conflict with use of physical force to control water resources; Open hospital and violent encounters occur.

3.3. Data Collection

To explore the dynamics of shared water resource management challenges in the Indus-Kabul River Basin, this study adopts the TWINs methodology. The variables of conflict and cooperation depends on various milestones based in an interstate bilateral relationship. Detailed analysis, including the data reviewed, and background of cooperation and conflict studies ratio are provided in appendix table 1 and 2, events and action (high level meetings) details is given in table 3 in appendix. The data is spanning from 2000 to 2024 for this analysis.

We have used the following formula to calculate the ratio. Arithmetic mean is taken for to calculate the intensity of all the values of conflict and cooperation over the years.

$$Average = (Sum\ of\ all\ values) / (Number\ of\ values) \quad \text{.....equation (1)}$$

$$TWINS\ matrix\ ratio = cooperation / conflict \quad \text{..... . equation (2).}$$

Equation number (1) shows the formula for arithmetic mean, the equation is used for to analyze the TWINS selected variables intensity in sample years of the study (Grünwald et al., 2020). Whereas equation (2) represents matric formula for to check the matric ratio of TWINs results overall (Reuveny, 2003). Higher the value of denominator leads to more opportunities for cooperation, lower the value leads to more conflict and threats of war.

4. RESULTS AND DISCUSSION

The transboundary water interaction nexus framework results for the Kabul-Indus basins are given below.

4.1. Limitation of the Study

Due to financial constraint, it was a challenge to access the published data of Afghan government due to two reasons 1) complete data is not available online because the official website of NSIA[9] is still underdeveloped, 2) language barrier, as many available data sets are in Afghan language which is hard to understand for the author. To overcome this obstacle, the author of the study has reviewed more than 200 relevant official documents of government of Pakistan, and of Afghanistan, published by World Bank, IWMI, CABI, student theses, published research studies and newspaper articles to create data harmonization.

4.2 TWINs Analyses

In given circumstances, the issue of water rights in Kabul River basin presents a complex challenge to cooperation between Afghanistan and Pakistan, because international convention favors upstream countries like Afghanistan, which generally have poor existing infrastructure for this reason. Demand for

[9] https://nsia.gov.af/.

Kabul-Indus treaty is getting momentum, as the Indus water treaty, and despite its limitation, demonstrates the viability of long-term agreements for managing water resources. TWINS analysis is a helpful tool to anticipate the direction of bilateral relationship among the countries (Syed and Choudhury, 2018; Ghulami, M. 2019; Walschot and Katz, 2022).

Table 3: Ratio of Conflict-Cooperation Intensity over Kabul-Indus Shared River Basin

Phases	*Conflict*							*Cooperation*						
	-1	-2	-3	-4	-5	-6	Ratio	+1	+2	+3	+4	+5	+6	Ratio
2000-2005	0	1	0	0	0	0	0.16	0	1	0	0	0	0	0
2005-2010	2	1	0	0	1	0	0.5	1	2	0	0	0	0	0.16
2010-2015	0	2	0	0	0	0	0.33	1	2	1	0	0	0	0.16
2015-2020	0	2	3	3	2	0	1.3	2	0	3	0	0	0	0.83
2020-2024	0	0	0	0	1	0	0.2	2	3	4	0	0	0	1.33
Results	3.0							3.7						

Table 3 depicts the intensity ratio of conflict and cooperation for Kabul River basin. Previous studies reveal that the intensity of cooperative opportunities has increased from 2015 to 2020. Many studies have used the coded word of: +1-Silent, +2 -Exploratory and +3-Strategic cooperation and collaboration. No study is found on +4-accountable, +5-intuitive and +6-affinitive criteria. This trend is largely due to the Afghan Taliban government coming into power, with the incumbent government seeking to electrify cities prioritizing hydropower power projects around the Kabul River basin. Some of these projects are planned on the Kunar River, which carries water from Pakistan. Any disruption to the river's upstream flow would significantly reduce the downstream river flow, creating an opportunity for cooperation on hydropower projects on the Kunar River, which could be a pivotal step toward fostering bilateral cooperation between the neighboring countries[10] (Asim, 2014). Climate change presents another potential cooperation opportunity, as the Kabul and Indus River tributaries have been among the most affected areas, experiencing intense flooding since 2005-06. In that period, nearly 14,866 m^3/s of water flowed through the Jinnah barrage, resulting in the loss of over 591 lives. In 2010, flood levels exceeded 10,000m^3/s at Nowshera, marking the largest flood since 1965. Neither KPK nor Afghanistan currently has any flood control mechanism (Ali, 2013). Although Pakistan's early warning system has been effective in recent years, it does not yet cover the entire Indus basin. Research articles published between the year 2015 and 2020 (Azam, 2015; Hayat, 2020; Lautze et al., 2023; Malik, 2019; Weinbaum and Majidyar, 2019) argue that there is a critical need to further explore evidence (+2-exploratory) for strategically addressing water issues between two neighboring countries. Various other studies and events are also documented and discussed the potential threats: -1 non-politicized conflict, -2 depoliticize conflicts, -3 re-politicized conflict, -4 politicized conflict, -5 scrutinized conflict, and -6 violent conflicts. The studies disclosed that how the non-cooperating behavior and threats are politicized and violent; so, we need to carefully scrutinize the events' outcomes influencing transboundary water resource management policy and its implications for the two neighboring stats. In terms of cooperation (+1, +2, +3), the research advocates further opportunities of collaboration and cooperation between the two countries due to cultural and ethnic proximity (Jamali et al., 2023). Since 2020, increase in temperature, glacial melt and early snow-melt related flooding, and unprecedented rainfall in early summers have aggravated the climatic and water stress. In addition, the growing population in the HKH region with exacerbating food demand and weakening infrastructure has underscored the need for transboundary integrated water resource management practices integration. However, trust deficits and non-state actors have been primary cause of stalemates in the negotiation process. For this reason, in December 2015, at ministerial-level conference, Pakistan expressed concerns over divided decision-making power in

[10] Energy security is crucial for both Afghanistan and Pakistan, because, the downstream areas of Khyber Pakhtunkhwa largely depend on Kabul River for irrigation and other household courses

Afghanistan, including issues related to shared water resource management (DAWN, 2024). Since 2019, bilateral relations have remained strained, because further complications stem from issues related to the Helmand River basin, because unsatisfactory implementation of the 1973 treaty with Iran, and Afghan hostility toward Pakistan undermined water resource development efforts at transboundary level between two of the countries (Baqai et al., 2021).

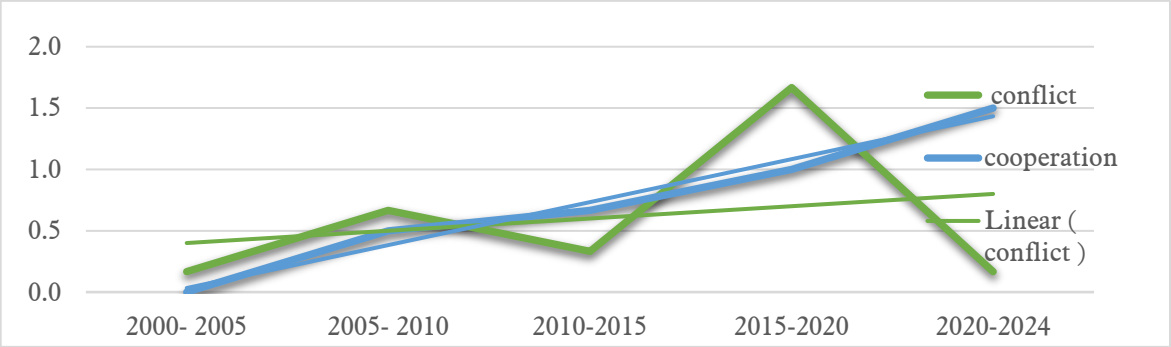

Figure 3: Cooperation and Conflict Intensities Graph

Figure 3 illustrates the evolving dynamics between the two states. The graph lines, derived from table 3, provide a clear visual representation of the trend in conflict and cooperation over the years. The trend line suggests that, particularly after 2010, there has been a growing recognition of the importance of transboundary water cooperation, as reflected in reviewed policies. While conflict persists and may even escalate in certain periods, the demand for cooperation has consistently outweighed the acceleration of conflict.

Table. 4: TWINs' Analysis - Overall Interstate Relationship

	Horizontal Axis (Cooperation)					
Vertical Axis (conflict).	*Silent cooperation (+1)*	*Exploratory cooperation (+2)*	*Strategic cooperation (+3)*	*Accountable cooperation (+4)*	*Affinitive cooperation (+5)*	*intuitive cooperation (+6)*
Non politicized conflict (-1)	*2002-2005*					
De politicize conflicts (-2)	*2006*					
Re politicized conflict (-3)			*2010- 2014*			
Politicized conflict (-4)	*2021*	*2020*	*2015*			
Scrutinized conflict (-5)	*2022*	*2023*				
Violent conflict (-6)			*2024*			

The table 4 depicts how circumstance have evolved over the years regarding conflict and cooperation opportunities for the two riparian countries. Since 2010, various studies in Pakistan and Afghanistan have analyzed the benefits of a transboundary water agreement between the two countries. However, the lack of a stable government in Afghanistan has consistently hampered these efforts. Particularly, after the U.S. withdrawal from Afghanistan in August 2021, the formation of the Taliban government further complicated the regional water dynamics (Shams, and Muhammad, 2023; Rasooli et al., 2024). Despite past tensions, a turning point emerged in December 2022, the discussion of a joint hydropower project on the Kunar River signaled a clear shift towards cooperation and trust-building

between the two countries. This newly found willingness to collaborate likely stems from growing interdependence, particularly in the face of shared challenges. Moreover, the multi- year drought in Afghanistan (2021-2023), coupled with floods and food insecurity, has underscored the vulnerability of both nations to climatic phenomena (Chen et al., 2024). This shared challenge has created a compelling incentive for interstate cooperation and the exploration of new collaborative opportunities.

Table 5: Ratio of Conflict Between Pakistan and Afghanistan

Conflict level	*Reference*	*Key Points*	*Outcomes*
Non-politicized	Lashkaripour and Hussaini (2008)	Benefit-sharing framework for transboundary water management	Advocates for a collaborative approach between Afghanistan and Pakistan, focusing on shared benefits beyond just water allocation.
De-politicized	Mack et al. (2010); Nafees, (2010); Qureshi (2002)	Water resources management in Afghanistan: The issues and options; Conceptual model of water resources in the Kabul Basin	Assesses water resources in Afghanistan considering challenges and limited data. Aims to understand current availability and project future needs. Provides insights into Afghanistan's water resource management context. Analyzes water management challenges in Afghanistan.
Re-politicized	Asghar et al. (2023); Majidyar (2018); Ramachandran (2018)	Afghanistan-Pakistan's looming water conflict. India's Controversial Afghanistan Dams. Thirsty Nations, From Conflict to Cooperation: Navigating the Climate Change Implications on Pak-Afghan Hydro-Politics	Highlights potential tensions due to Kabul River dam construction by Afghanistan with Indian assistance, impacting downstream Pakistan. Heightened tensions and disputes between Afghanistan, Iran, and Pakistan over water resources. Potential negative impacts on downstream countries' agriculture and water supply. Increased geopolitical complexities in the region due to competing water interests. Examines the impact of climate change on Pak-Afghan water relations and the need for cooperation. Advocates for a shift towards cooperation to address shared water challenges
Politicized	Hanasz (2014); Kausar et al. (2022); Khan and Nafees (2018); Salman et al. (2018);	Kabul River water dispute: Pakistan-Afghanistan conflict. PAK-AFGHAN WATER DISPUTE: AN ANALYSIS. Pakistan-Afghanistan Transboundary Water Governance, Power Flows: Hydro-hegemony and Water Conflicts in South Asia	Analyzes ongoing dispute over water sharing. Afghanistan asserts development rights, while Pakistan fears water shortages. Highlights the contentious nature of the water sharing issue. Analyzes the political dimensions of the Pakistan-Afghanistan water dispute. Analyzes the concept of hydro-hegemony in South Asia and its impact on water conflicts. Highlights the role of power dynamics in water management and the need for cooperation. Examines the governance challenges in transboundary water management between Pakistan and Afghanistan. Highlights the need for improved cooperation and institutional frameworks.
Scrutinized	Hayat (2020); Houben et al. (2009);	Hydrogeology, power dynamics, multilevel governance, inclusive development; Benefit-	Emphasizes critical need for hydrogeological data to manage Kabul's water supply challenges. Highlights importance of collaborative management,

	Sadeqinazhad et al. (2018)	sharing framework in transboundary river basins: the case of the Eastern Kabul River Basin-Afghanistan	power dynamics, legal frameworks, and social/ecological aspects. Proposes a benefit-sharing model for transboundary cooperation. Advocates for collaboration and shared benefits in water management.

Table 6: Ratio of cooperation Between Pakistan and Afghanistan

Cooperation Type	*Author Information*	*Key Points*	*Outcomes*
Silent Cooperation (Provides information for better management, but cooperation not the main focus) Silent Cooperation (Provides technical information that could be used for cooperation)	Andik and Mianabadi (2023); Hayat, and Elci (2017); Rasouli et al. (2015)	1. Focuses on estimating discharge from the Upper Kabul River Basin. Provides data for understanding water flow patterns. Reviews water resources, challenges, and proposes a framework for Afghanistan to manage transboundary waters. 2. Assesses the Kabul River Basin with a focus on existing and planned reservoirs. Highlights challenges like data scarcity, soil erosion, and water pollution. Recommends solutions for improved water management. 3. Disputes over the Kabul River go beyond technical water management issues. They are intertwined with economic, political, and security concerns	1. Offers a technical tool for water resource assessment, but doesn't address cooperation directly. The model can be used for estimating discharge in snow-fed sub-catchments. 2. Adopts a Strategic Framework for Transboundary Water Resources Management in Afghanistan. Highlights the need for strategic management considering hydro-hegemony, conflict resolution, and international examples. 3. Silent Cooperation (Provides information for better management, but cooperation not the main focus). Provides valuable data for basin management but doesn't address cooperation directly. 4. Emphasizes the complexity of water management in this region. Addressing water issues requires a holistic approach considering broader geopolitical factors.
Exploratory Cooperation	DAWN (2024); Neale (2024); Smolenaars et al. (2022)	1. Advocates for a benefit-sharing approach to address shared water challenges. Proposes a shift from conflict to cooperation in water management. 2. Exclusion from International Climate Processes: The Taliban government has been excluded from the United Nations climate process, likely due to international sanctions and political isolation.	1. Traditional strategies may not be sufficient for future challenges. Future water requirements may exceed availability in some sub-basins. 2. Shared water management needs to account for rapid socio-economic changes. 3. Foundation for Future Cooperation: The talks could lay the groundwork for more substantial collaboration on climate change initiatives. 4. The Taliban government's engagement with international organizations could lead to

		3. Humanitarian Crisis: The combined effects of conflict, poverty, and climate change have created a severe humanitarian crisis in Afghanistan. 4. Need for Urgent Action: The article emphasizes the urgent need for international support and cooperation to address the climate challenges facing Afghanistan.	increased support for climate adaptation and mitigation efforts in Afghanistan. 5. The article highlights Afghanistan's vulnerability to climate change, calls for international support to address the humanitarian crisis, and could contribute to advocacy efforts for climate justice.
Strategic Cooperation	Atef et al. (2019); Azam (2015); Khalid and Iqbal (2020); Lautze et al. (2023); Malik (2019); Shams, and Muhammad (2022)	1. Presents a state-of-the-art review on transboundary water issues. Emphasizes cooperation and benefit-sharing. 2. Advocates for a cooperation framework. 3. Advocates for a shift from conflict to cooperation in water management. 4. Proposes a framework for cooperation and joint management.	1. Emphasizes shared goals and an integrated approach. Enhanced water, food, and energy security. 2. Government's crucial role in promoting cooperation. Proposes a decision support tool for transforming conflict into cooperation. 3. Traditional approaches based on absolute territorial rights are not effective.

Table 7: Events and Meetings between Pakistan and Afghanistan High Level Officials

Year	*Event*	*Cooperation Level*	*Conflict Level*
2005	Pakistani delegation visits Khost province for discussions on hydropower	Exploratory Cooperation (+2)	-
2006	World Bank intervention fails to secure a transboundary agreement		- Non-Politicized Conflict (-1)
2009	Islamabad Declaration mentions regional collaboration	Exploratory Cooperation (+2)	-
2013	Discussion on joint power project	Exploratory Cooperation (+2)	-
2014	APJCC pledges to explore joint power-sharing agreement	Exploratory Cooperation (+2)	-
2014	Bilateral talks facilitated by the World Bank	Strategic Cooperation (+3)	-
2014	Talks stall due to political issues	-	De-Politicized Conflict (-2)
2015	Regional climate change conference	Exploratory Cooperation (+2)	-
2015	Trilateral meeting on joint power project	Strategic Cooperation (+3)	-

5. CONCLUSION

The analysis of the Kabul-Indus River basin through the TWINs framework reveals a complex interplay between cooperation and conflict over shared water resources. While opportunities for

collaborations have increased in recent years (2010-2024), particularly in terms of strategic cooperation, historical tension and political instability in Afghanistan continue to hinder the progress. Moving forward, building trust and addressing historical grievances will be crucial for establishing a sustainable framework for managing water resources in the Kabul-Indus basin. A Kabul River basin treaty, similar to the Indus water treaty, could provide a foundation for long-term cooperation. The UNECE 1992 Transboundary Water Cooperation Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) could be the most fitting option due to its flexibility of implementation. Because 1992, and 1997 Water Conventions provide the basis for equitable and reasonable utilization of shared water resources with the broader objective to ensure equality and equity as per internally set standards. These conventions allow non-binding multilateral water agreements between the nations sharing transboundary water resources. In the context of Pakistan and Afghanistan, a ray of hope and potential turning point emerged in December 2022 with the discussion of joint hydropower dam construction on the Kunar River. The recent devastating drought in Afghanistan exemplifies the shared challenges, highlighting the need for regional cooperation and opportunities to foster trust by addressing historical grievances. This strategy could be crucial for establishing a sustainable framework for managing water resources in the Kabul-Indus Shared River basin. Indeed, significant hurdles between the two countries are likely to remain constant due to political polarization in Afghanistan and historical instability. However, the shared vulnerability to climate change and water scarcity, could serve as powerful motivator for both countries. This shared threat can push them to overcome political differences and collaborate on sustainable solutions. By focusing on mutual objectives, both the countries can ensure a more secure and prosperous future for their citizens. The study's findings are valuable for policymakers, hydro-diplomats, policy think tanks, and academia in understanding the nature of conflict in the KRB basin and exploring potential solutions, particularly, when population pressure, climate change and governance issues are persistent alongside the financial constraint at regional level and national level both.

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AUTHOR'S DECLARATIONS AND ESSENTIAL ETHICAL COMPLIANCES

Author's Contributions (in accordance with ICMJE criteria for authorship)

Contribution	*Author 1*	*Author 2*
Conceived and designed the research or analysis	Yes	Yes
Collected the data	Yes	No
Contributed to data analysis & interpretation	Yes	Yes
Wrote the article/paper	Yes	No
Critical revision of the article/paper	Yes	Yes
Editing of the article/paper	Yes	Yes
Supervision	Yes	No
Project Administration	Yes	No
Funding Acquisition	No	No
Overall Contribution Proportion (%)	70	30

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